Extraction system location, appearance and operation.

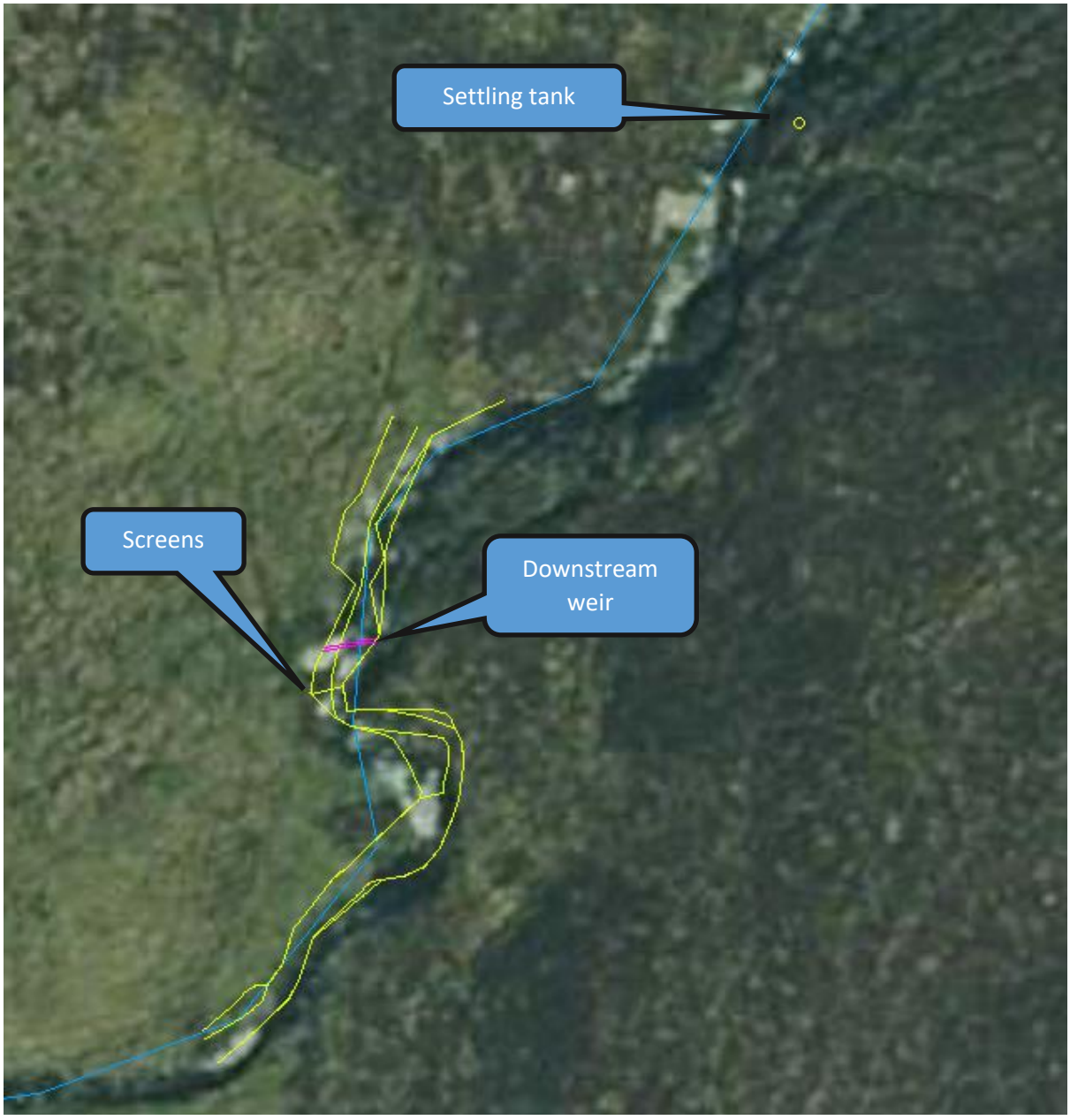

Figure 1. Plan view of extraction area (image approximately 60 m x 60 m).

Figure 2. Surveying the stream at the point where the screens will be located.

Figure 3. Extraction point, looking upstream.

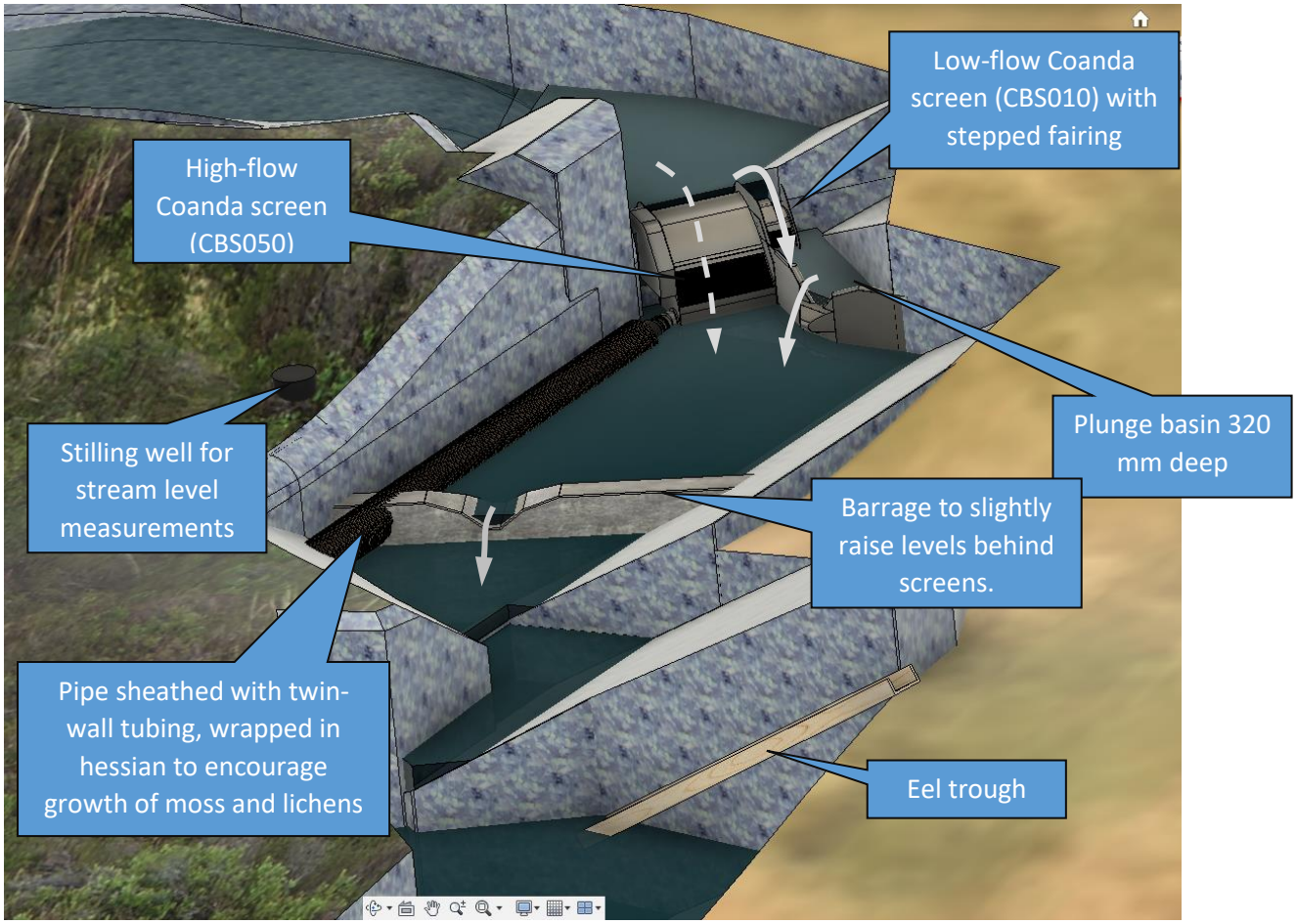

Figure 4. Abstraction system. Fish can progress up and downstream in three stages (black arrows), with jumps of less than 25 cm. Water levels shown for stream flow of 4 litres/sec, Q95. At higher stream levels, water starts to flow over the high flow screen (dashed arrow). See abstraction licence submission for further details.

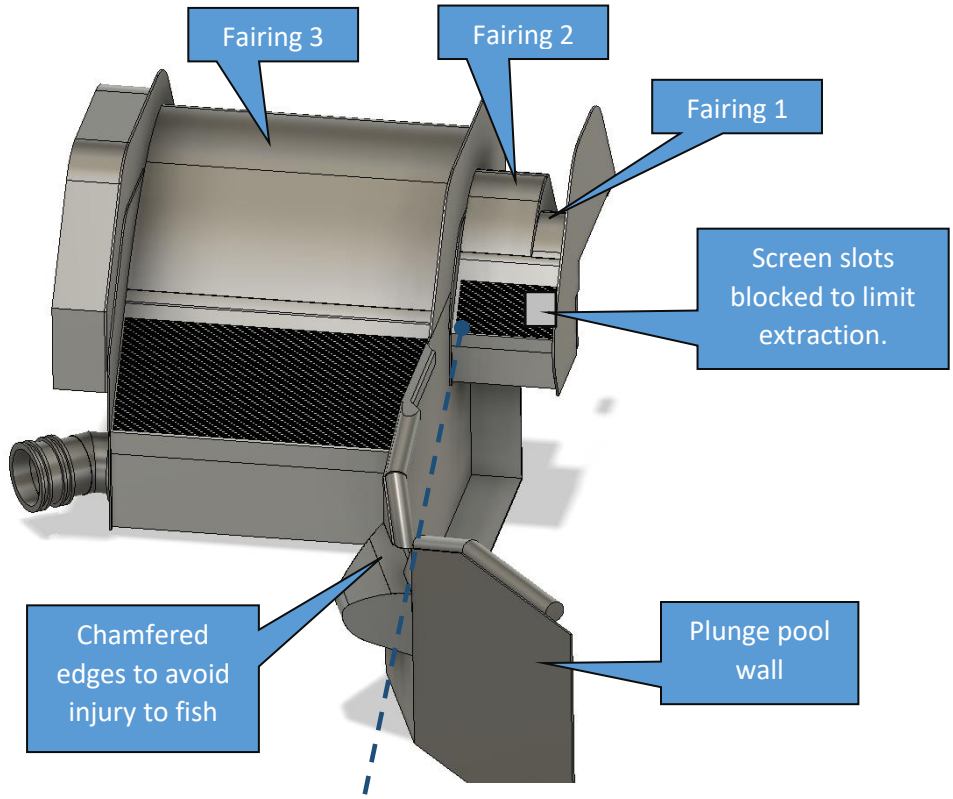

Figure 5. Arrangement of screen boxes and fairings.

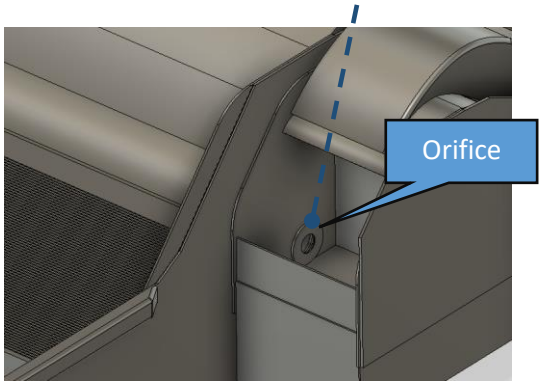

Figure 6. Screen removed to show flow-limiting orifice.

Coanda screens with 1 mm slots are used to extract the water without catching debris. The screen boxes have three fairings to divide the stream flow between them. The crest heights have been chosen such that when the stream flow is above 4 litres/second (95th centile), some of the water passes over fairing 3 and can be extracted by the main screen. This size of screen cannot extract more than 14.2 litres/second.

For 5% of the year the flow the stream flow will be less than 4 litres/second; no water then passes over the large screen. Extraction through the smaller screen is regulated by an orifice (Figure 6) which can only pass 0.6 litres/second, thereby safeguarding the stream flow in dry conditions.

In exceedingly dry conditions (e.g. late June 2018) flows as low as 2.5 litres/sec have been observed. The lowest *LowFlows* predicted flow is 1.8 litres/sec (Q99.9 for September i.e. one month per 1000

years). Under such very dry conditions, there will be little water passing over fairing 2 - most of the it will pass over fairing 3. The screen slots below fairing 3 will be almost completely sealed off such that no more than 0.05 litre/sec of the fairing 3 flow can be extracted. This protects the stream flow if such dry conditions should ever occur; the hydro system will shut down leaving the 0.05 l/s for domestic use in the cottage (see abstraction licence submission for graphs and calculations).

The extracted water from the screens is likely to contain air bubbles which might air-lock the penstock or cause large pressure fluctuations at the turbine. These will be allowed to escape via a settling tank about 40 m down from the screens. The tank is basically a section of pipe, capped and stood on end (Figure 7(a)); it is approximately 2 m high. It will be hidden from view behind a tall section of shiplap fencing, Fig. 7(b).

Figure 7. Settling tank (a) pipe section, (b) cladding to hide it.

The tank will be invisible from a distance because it is recessed into a natural cleft in the rock face, Figures 8, 9 & 10

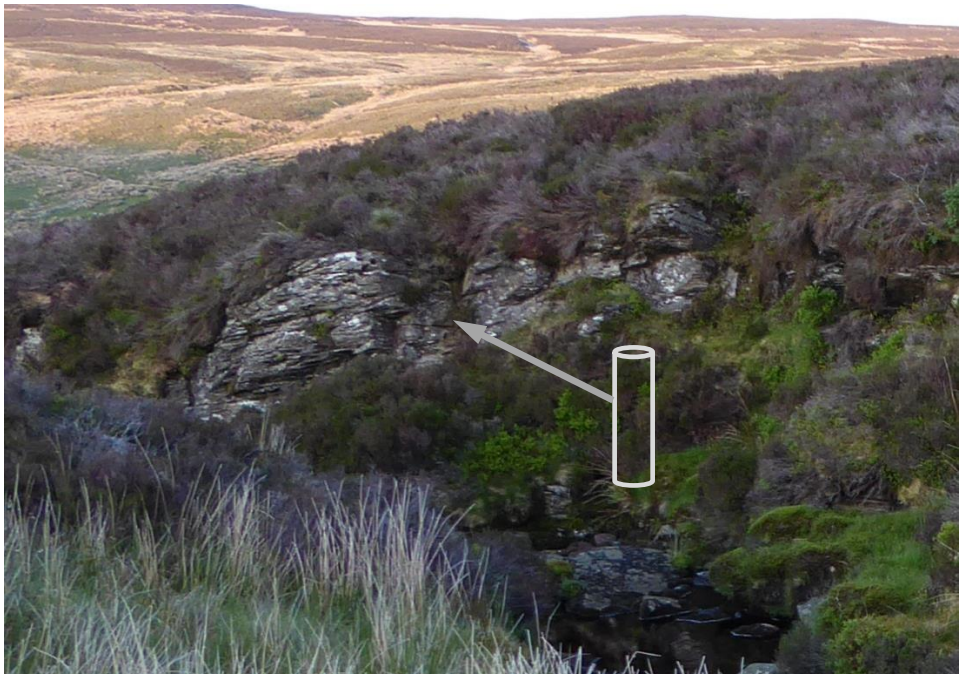

Figure 8. Settling tank location.

Figure 9.

Figure 10.

The tank will be full when the turbine is only using a small flow rate. At higher flow rates the head loss in the pipe from the screens leads to a lower level in the tank.

In dry conditions the screen orifice limits the extracted flow to 0.6 litre/second; this cannot suddenly increase whenever a tap is opened in the cottage, so the tank level will start to fall. A level sensor in the tank will detect that the tank is emptying and send a signal to reduce the turbine flow rate. The reduction in flow has to occur gradually to avoid water hammer effects: the tank buffers the flow during this process.